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Original article

SARS COV-2- IgG antibodies in blood donors in pandemic – A game changer for policy makers

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ARTICLE INFO

Article history:
Available online xxx

Keywords:
Blood donors
COVID 19
Innate immunity
SARS-COV2-IgG antibody

ABSTRACT

Background. – A novel beta coronavirus, named Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2), has been identified as the causative pathogen for the present pandemic. The objective of the study was to measure the levels of IgG antibodies targeting the SARS-CoV-2 during the peak period of the COVID-19 pandemic in Odisha State, India to know the magnitude of SARS-CoV-2 exposure, the prevalence of herd immunity in the population, the distribution of IgG-positive cases examined according to ABO blood groups and the number of blood donors with higher neutralizing IgG antibody titre who later on were converted into Plasma Donors donating Convalescent Plasma (CP).

Method. – This observational prospective study was conducted for a duration of three months on 1032 number of Blood donors consisting of 1025 number of males and 07 number of females. The samples of donors were subjected to Electro- chemiluminescence immunoassay (ECLIA) to detect SARS-CoV-2 IgG antibodies.

Result. – Out of 1032 Donors, 370(35.9%) were SARS-COV-2 IgG positive which included 303 donors (29.36%) with neutralizing antibody titre of SARS-COV2 IgG antibodies above 1:80. SARS-COV-2 IgG positive cases consisted of 367(35.8%) male and 3(42.9%) female donors. The number of IgG positive cases were highest in 21–40 years' age group i.e. 323 out of 869(37.2%). In terms of Blood group, 145(42.4%) out of 342 were from B RhD positive group. Out of 22 donors who were positive with COVID 19 in the past with neutralizing IgG antibody titre more than 1:80, 6(27.3%) persons came for voluntary convalescent plasma(CP) donation.

Conclusion. – A high prevalence of SARS-CoV-2 antibodies was detected among blood donors which indicated a high level of exposure to the virus within the population and development of innate immunity against the virus. Policy makers can add the protocol of antibody testing in the screening of blood donors to enhance the number of Plasma Donation cases for the treatment of serious COVID patients.

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1. Introduction

During late 2019, cases of severe pneumonia with an unidentified aetiology began to emerge in Wuhan, China, before spreading first within China and then globally. A novel beta coronavirus, named Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2), was identified as the causative pathogen of this condition, which was later named coronavirus disease 2019 (COVID-19). This virus can be transmitted in humans by direct or indirect contact with respiratory droplets of an infected person [1]. Although the viral RNA has been detected in stool, blood and urine of COVID-19 patients, transmission via these routes have not yet been docu-

mented [2,3]. It is not known whether COVID-19 can be transmitted by blood transfusion. Respiratory viruses have never been reported to be transmitted through blood or blood components; therefore, any potential risk of transmission by transfusion of blood collected from asymptomatic individuals is theoretical [4]. Infection with SARS-CoV-2 often presents with no symptom (asymptomatic) or mild symptoms like fever, dry cough, muscle pain, loss of taste, loss of smell etc and can even progress into severe forms of the illness and possible death especially in the elderly and/or persons living with other comorbidities [5,6]. Asymptomatic infections may be a substantial source of transmission and a challenge to infection control measures [7].

In India, the first case of COVID-19 was reported on January 30, 2020 [8]. There is a wide variation in the reporting of cases across the States/Union Territories and across the districts within each State. The case reporting is based on the testing of

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<https://doi.org/10.1016/j.traccli.2021.10.004>

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individuals by Real-time reverse transcription-polymerase chain reaction (RT-PCR) and rapid antigen testing. But, the current testing criteria, which prioritize the allocation of testing capacity, can miss many asymptomatic, mild infections and previous, non-active viral infections. Therefore, serological tests might represent a useful method through which to investigate the prevalence of previous SARS-CoV-2 infections within the community can be determined and this would support the continued efforts to minimize the viral transmission rate and the design of sensible public health policies.

Antibodies to SARS-CoV-2 are produced by the adaptive immune system in response to virus exposure, at least in the vast majority of cases, serology based tests for SARS-CoV-2 may be used to determine the extent of asymptomatic SARS-CoV-2 infections and to monitor the COVID-19 pandemic. In this study, our objective was to measure the levels of IgG antibodies targeting the SARS-CoV-2 during the peak period of the COVID-19 pandemic in Odisha, India to know the magnitude of SARS-CoV-2 exposure & the prevalence of herd immunity in the population. In addition, the distribution of IgG-positive cases was examined according to ABO blood groups and the number of blood donors with higher neutralizing IgG antibody titre who later on were converted into plasma donors donating Convalescent Plasma (CP).

2. Materials and methods

2.1. Study design

The study was observational prospective study conducted in the Department of Transfusion Medicine, Sriram Chandra Bhanja(SCB) Medical College & Hospital, Cuttack, Odisha State, India for a duration of three months from 1st November 2020 to 31st January 2021 on 1032 number of Blood donors after taking approval from the Expert Committee, Health & Family Welfare Department, Government of Odisha.

2.2. Inclusion criteria

- Age group between 18–65 years;
- Those who have neither any history of fever (body temperature $\leq 37.3^{\circ}\text{C}$) nor any respiratory symptoms for at least 28 days;
- Body temperature being normal before donation ($\leq 37.3^{\circ}\text{C}$);
- Donors were informed regarding the antibody testing against COVID 19 infections. Only those who gave consent to be tested for SARS- COV-2 IgG antibodies were included in the study;
- Those with Haemoglobin > 12.5 g/dl, platelet count $> 150,000$ per microliter of blood and Total Leukocyte Count within normal limits were accepted;
- All participants who were confirmed to be free from all viral infections including Hepatitis B and C, Human immunodeficiency virus (HIV) 1 and 2 after being tested with Enzyme linked Immosorbent Assay (ELISA) and Nucleic Acid Amplification (NAT) testing.

2.3. Exclusion criteria

- Following individuals with any of the following criteria/symptoms were excluded from the study as per the Drugs and Cosmetics Act of 1940 (as amended up to the 31st December, 2016) of Govt. of India [9]:
 - Who were below 50 kg,
 - Under 18 years or above 65 years,
 - Having Haemoglobin of less than 12.5gm%,
 - Recently recovered after surgery,
 - Recently received blood transfusion,
 - Suffering from chronic respiratory diseases (asthmatic attack, asthmatics on steroid),

- Cardiovascular diseases (myocardial infarction, hypertensive heart disease, coronary artery disease, angina pectoris, rheumatic heart disease),
- Endocrine diseases (diabetes on insulin, hyper/hypothyroid, thyrotoxicosis due to Graves' disease),
- Chronic infection of kidney/renal failure,
- Any carcinoma,
- Suffering from HIV, Hepatitis B/C, Syphilis, Gonorrhoea, Leishmaniasis, leprosy;
- Those who presented physically identifiable symptoms of any infection, including cough, sore throat, or fever;
- Those who did not give consent to be tested for SARS- COV-2 IgG antibodies.

2.4. Electro-chemiluminescence immunoassay(ECLIA)

The samples were collected from the Donors who came voluntarily for the blood donation and agreed to undergo the screening of the IgG antibodies against SARS-COV-2 infection. These voluntary blood donors were the contact subjects. They were later on informed regarding the value of IgG antibodies present in their body after getting the results. The samples were allowed to settle in clot retraction or EDTA vials for around 10–15 min after proper mixing to be tested by ECLIA technology (Abbott Architect i2000SR). The vials were centrifuged for 20 min at 4200 revolutions per minute (rpm) or more after clotting. Control run valid for 24 h was necessary before processing the donor samples. After control run, samples were run in the system. As per the report by ECLIA, Donors with positive SARS-COV-2 IgG antibody were divided into two groups—those with neutralizing antibody titer less than 1:80 and those with more than 1:80.

3. Results

3.1. Result of SARS-COV-2 IgG antibody along with neutralizing antibody titre

Out of 1032 Donors, 370(35.9%) were SARS-COV-2 IgG positive and 662(64.1%) were IgG antibody negative. Out of 370 SARS-COV-2 IgG positive cases, 303 donors had neutralizing antibody titre of SARS-COV2 IgG antibodies above 1:80.

3.2. Result of SARS-COV-2 IgG antibody in reference to gender of Donors

There were 1025 number of male and 07 number of female donors, out of whom 367(35.8%) male and 3(42.9%) female donors were SARS-COV-2 IgG positive (Fig. 1).

3.3. Result of SARS-COV-2 IgG antibody in reference to age of donors

Age of Blood Donors ranged from 18–60 years with maximum number (869) from 21–40 years' age group. The number of SARS-COV-2 IgG positive cases was highest from 21–40 years' age group i.e. 323 out of 869 (37.2%). This was followed by 29.7% from 41–60 years' and 26.9% from 18–20 years' age groups respectively (Fig. 2).

3.4. Result of SARS-COV-2 IgG antibody in reference to blood group of donors

The number of Blood Donors with highest number of positive SARS-COV-2 IgG was 145(42.4%) out of 342 from B RhD positive group. This was followed subsequently by 33.6% & 33.5%

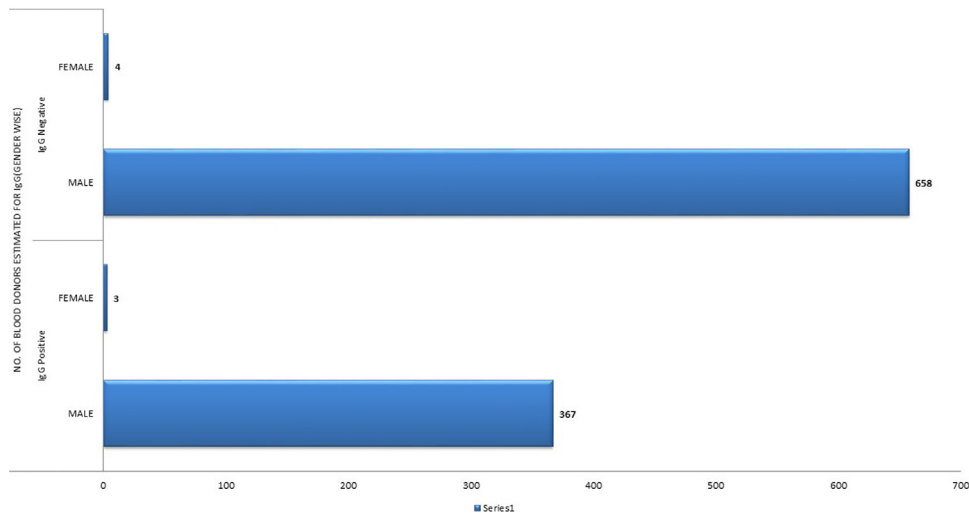


Fig. 1. Number of blood donors estimated for SARS-COV-2 IgG gender wise.

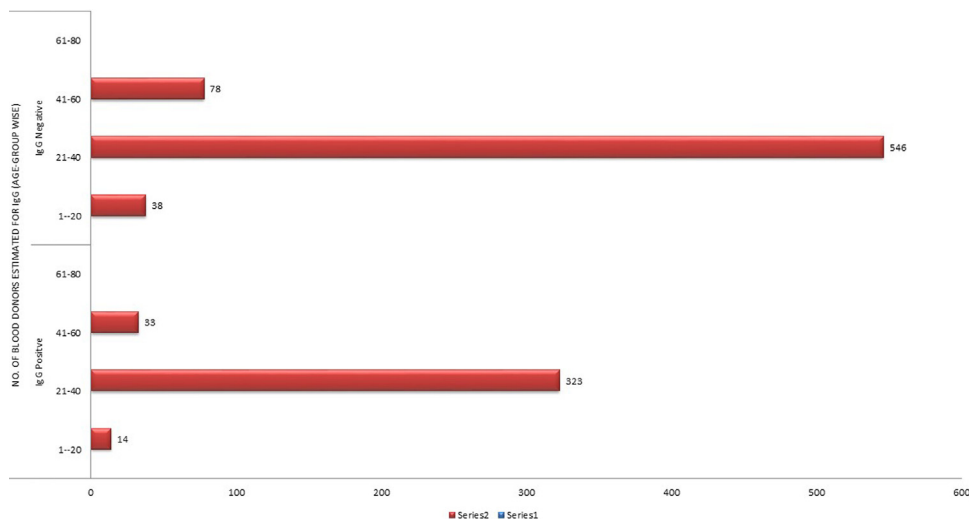


Fig. 2. Number of blood donors estimated for SARS-COV-2 IgG age group wise.

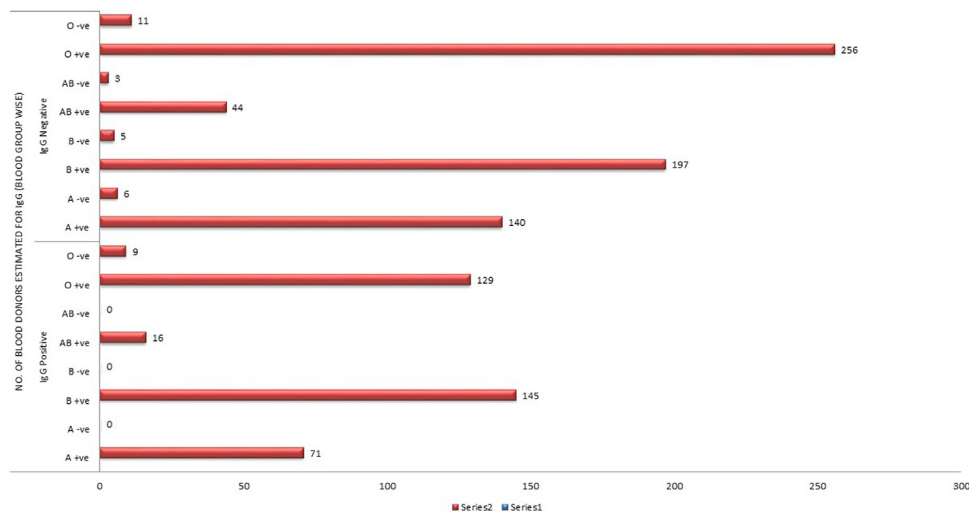


Fig. 3. Number of blood donors estimated for SARS-COV-2 IgG blood group wise.

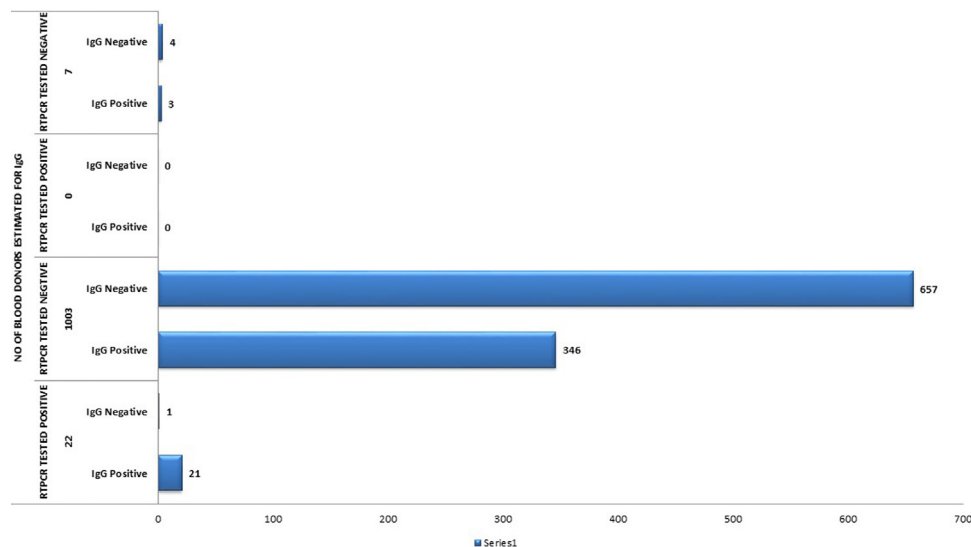


Fig. 4. Number of blood donors estimated for SARS-CoV-2 IgG RTPCR report wise.

from blood groups A RhD and O RhD positive. Least percentage was found in AB RhD positive (26.7%) (Fig. 3).

3.5. Result of SARS-CoV-2 IgG antibody in reference to past COVID infection of donors

Among 1032 donors, 1010 had never suffered from COVID-19 infections in the past. Of these 1010 persons, 361 (35.74%) cases had positive SARS-CoV-2 IgG. The number of persons who had suffered from COVID-19 infection in the past with positive report of RTPCR test was 22. They had come for blood donation with a median day of 40 after complete recovery from COVID. Out of these 22, 6 (27.3%) persons had neutralizing IgG antibody titre of more than 1:80. Later on, these 6 individuals turned up as voluntary convalescent plasma (CP) donors (Fig. 4).

4. Discussion

The world is facing crisis and challenges with communities and economies everywhere affected by the COVID-19 pandemic. Seroepidemiological research study can help in the detection of asymptomatic or subclinical infections in the overall population. As SARS-CoV-2 is a novel virus, the surveillance of antibody seropositivity is likely to offer valuable information regarding the true magnitude of the infection. Social distancing and other public health measures are placing an increasing psychological burden on people, resulting in an increasing need for exit strategies [10]. COVID-19 is an acute respiratory disease whose specific treatment is still not established. One of the options in the treatment is Convalescent plasma (CP) therapy with required amount of neutralizing antibodies in the plasma of recovered COVID patients. In the present study, we systematically reviewed the seroprevalence of IgG antibody in healthy donors and tried to collect CP from the donors with neutralizing antibody titre more than 1:80 from those who were willing to donate. Though high levels of neutralizing antibodies were found in donors who donated under 60 days from diagnosis of COVID-19 [11], in our study we also found presence of IgG antibody in 361 (35.74%) out of 1010 persons who were never affected with COVID in the past. This indicates a high level of exposure to the virus within the population and development of innate immunity against the virus.

The seroprevalence of 35.9% in our study is comparable to other studies ranging from 24.4%–33.7% obtained at different points in

time among blood donors in Pakistan and France [12,13]. The high rate of seropositivity to SARS-CoV-2 antibodies in our study suggests a wider circulation of the virus at the community level by the end of the first wave of resurgence of the pandemic. In COVID-19 patients, gender, age, and ABO blood type were reported to be associated with the occurrence or the development of the disease. Compared to females, male patients have had higher mortality (22.2% vs. 10.4%) and required longer hospitalization time [14]. In our study, male donors (1025) outnumbered the female donors (07). Indian females are subjected to more number of deferral at the time of blood collection due to various reasons like malnutrition, underweight, anaemia, etc., leading to reduced number of female blood donors. Our study revealed that the SARS-CoV-2 seroprevalence was significantly higher among females than in males among healthy donors. Taken together, it was possible that females have more probability for asymptomatic infections whereas males are more likely to suffer symptomatic disease. The gender-difference could be attributed to oestrogen receptor signalling mediated protections, which had been demonstrated in previous SARS-CoV animal study [15].

A relationship appears to exist between an individual's ABO blood type and the possibility of contracting a SARS-CoV-2 infection following exposure. Type B blood donors showed the highest frequency of anti-SARS-CoV-2 IgG antibodies in contrast to the results of a recent meta-analysis showing that SARS-CoV-2-positive individuals were more likely to have type A blood than the other blood types [16]. A study performed by Guillon et al. reported that a monoclonal anti-A antibody or a natural plasma-derived anti-A antibody was able to definitely inhibit the SARS-CoV-2 S protein/ACE2-dependent adhesion to ACE2-expressing cell lines [17]. Since highest number of blood donors belonged to the age group 21–40 years, the seroprevalence was highest in this age group. However, recent study has correlated the increased vulnerability to infection with increasing age. The age-dependent pattern of disease severity has been well established; however, the underlying reasons for the differential spread of the virus among different age groups remain unclear [16].

The prevalence of SARS-CoV-2 among blood donors can give an insight into the spread of the virus among healthy people, which can assist in the development of approaches designed to diminish transmission. But, few reports have been published in medical literature on the incidence of SARS-CoV-2 among blood donors to date. Our results suggest the existence of a high prevalence of

SARS-CoV-2 antibodies among the blood donors, which may be due to wider circulation of the virus at the community level by the end of the first wave of the pandemic.

It is very important to recognize the incidence of SARS-CoV-2 infections among asymptomatic individuals as healthy people in epidemic regions may be similarly infected and remain asymptomatic, acting as major viral transmission reservoirs. Herd immunity is partially created with the extent of infection both with symptomatic as well as asymptomatic persons within a community [18]. Our study revealed high prevalence of SARS-CoV-2 seropositivity (35.9%) in comparison to those reported in other countries. Still, the value is much lesser than the required prevalence of 60%–70% level that has been proposed to be necessary for the establishment of herd immunity [19].

In the present study, with much convincing, we could collect the neutralizing IgG antibody titre of more than 1:80 from 6 (27.3%) out of the 22 Blood donors who had positive RTPCR report in the past but had come for voluntary convalescent plasma (CP) donation. Later on, the policy makers can introduce the screening of Blood Donors for IgG antibody to motivate them for plasma donation in future if they will give consent. This can mitigate the scarcity of Convalescent Plasma, which has benefits for improvement of serious COVID patients [20].

5. Conclusion

Persons donating blood are said to be healthy donors as they are thoroughly screened before being accepted for donation. The present study had high seroprevalence of SARS-CoV-2 antibodies among blood donors, higher with donors with female gender, 21–40 years' age group and blood group of B Rh D positive. In the present pandemic, the screening for antibodies against SARS-CoV-2 can act as an indicator of the picture of the protection of the community against the novel virus. Policy makers can also add the protocol of antibody testing in the screening of blood donors. This is likely to act as an incentive and helps enhance the number of plasma donation cases for the treatment of serious COVID patients.

Financial support & Sponsorship

There has been no financial support/sponsorship from any source for this research work.

Disclosure of interest

The author declares that they have no competing interest.

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